Common Risk Characterization Strategies for the Drainage EU Ecological Risk Assessments.

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The drainage EUs appear to have similar types of ECOPCs with some exceptions. In order to provide consistent EU Ecological Risk Assessments, the following common strategies will be put in place – within the Risk Characterization Step of the ECOPC evaluation process.

It should be noted that the standard ECOI evaluation steps as per the CRA will be followed to the fullest extent. Maps depicting all observed exceedances of ESLs will be provided up front along with the standard tables summarizing the chemicals detected, the summary statistics, comparison to ESLs etc. This memo focuses upon the final phase of the ERA, the Risk Characterization Strategies. Standard format approaches to the drainage EUs are as follows;

- ✓ Each media will be addressed independently (surface water vs sediment). Towards the end of the Risk Characterization, the results will be combined if ECOPCs are common between the two media.
- ✓ 'Groups' of chemicals will be evaluated within the Risk Characterization (ie total PCBs, and total PAHs, metals, other semi-volatile chemicals [other than PAHs], pesticides etc.). This is not to indicate that individual chemicals will be ignored. Individual chemicals will be comprehensively addressed. They will be listed underneath chemical group headings (ie metals).

Within the Risk Characterization portion of the text, general strategies for the characterization will be applied in all cases, and specific strategies pertinent to the type of ECOPC will be applied when appropriate. These are described as follows;

General Strategies

Initial General Strategy: Consistent with the WAEU a '**toxicology**' evaluation will be the initial strategy for the characterization.

> The initial step within this strategy will be a standard HQ comparison of already established EPC values (maximum and 95 UCL of the 90^{th}percentile) to the primary (approved values within the CRA) and secondary (see **Table1**) to present a risk quotient range. The secondary ESL values in some cases are adjustable (ie sediment PAH ESLs using the EqP approach, or surface water divalent metal

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ESLs using site specific hardness values). The proposed standard secondary ESLs are provided in **Table 1**. The rationale for their selection is described.

The <u>second step</u> within this strategy will be the presentation of a brief toxicity profile of the ECOPS (a paragraph summary). The summary will target a description of bioavailability, bioaccumulation and toxicity specific to the receptors present. [The SAME toxicity profile paragraph summaries will be provided for each Drainage EU risk characterization for those ECOPCs that are in common].

The third step could involve further ESL evaluation. As noted within the OU 5/OU 6 (and OU 3) evaluations, the species present are typically warm-water, opportunistic species. The AWQC documents do provide toxicity thresholds for such species. It may be worth the effort to obtain these values and provided them within the risk characterization.

Specific strategies by Chemical type:

Metals: hardness derived criteria can be adapted using site-specific hardness values for surface water,
AVS application to sediment? for site-specific sediment values

PAHs: Aquatic life tends to be less susceptible to PAHs than other groups of receptors. Literature information describing this receptor categorie's ability to metabolize and detoxify these chemicals is widely known. That literature (Eisler, 1989) can be revisited, and does describe individual PAH toxicity information.

PCBs: Total PCB concentrations will be compared to alternative values (MacDonald et al., 2000), however – as per the guidance these values (TEC, MEC, EECs) can not be used as a sole measure of toxicity. The risk can only be characterized by using a 'triad' approach with available tissue data, and comparison of tissue data to accepted tissue concentrations. This can be accomplished with the use of the tissue data derived from the OU 5/OU 6 report. All observed concentrations will be mapped using color codes to depict sites that exceed the three levels developed by MacDonald as follows:

Gray:	values equal or less than the TEC
Yellow:	values > TEC but < MEC
Orange:	values > MEC but < EEC
Red:	values > EEC

The definitions for these levels and the associated concentrations are provided in **Table 2**.

The <u>**Second General Strategy**</u>: Aquatic ecology risk is dependent upon the '**nature and extent'** of ECOPCs within aquatic habitat areas.

The <u>initial step</u> of this strategy is to identify the viable habitat areas within maps of the EU, overlain with ECOPC data (statistics will NOT be re-run based upon this area isolation method). A thorough description of the habitat areas within and down-gradient of the EU will be provided. Hydrographs are available for most drainages, as are ecological receptor descriptions from previous studies. A discussion of the completeness (or lack there-of) of exposure will be provided. It will be recognized that although the ECOPCs may occur currently in non-habitat areas, they pose a potential future threat if transported down-gradient to viable habitat.

Once the nature and extent of ECOPC occurrence within viable habitat areas is described, the <u>second step</u> within this strategy is to provide additional details such as the frequency of detection (within habitat areas), the magnitude of ESL exceedance within habitat areas (can use the 'exposure curve' idea or other, to depict number of exceedances within, or outside of habitat areas), and site specific conditions which may circumvent ECOPC toxicity (ie TOC, hardness or intermittent flow).

Metals: Loading analysis using flow data can be used to determine if a stream is gaining or losing contaminants. This helps to determine if the site (ie the IA or IHSS's etc) are potential sources, and if the site as a whole is a source to off-site areas. Loading analysis is dependent upon the applicable type of data set being available for this interpretation.

Table 1. Alternative ESLs for ECOPCs						
ECOPC	Alternative (secondary) ESL					
	Range of Reported ESLs (source: GP document)	MacDonald et. 2000	Ingersoll et 1996 ERM	USEPA, 1997	Cubbage, et 1997	Other
Aluminum	15900 – 58000 mg		58000 mg			
Antimony	2 – 500 mg					3.2 [1] mg
Arsenic	3 – 150 mg	33.0 mg	50 mg			
Barium	20 – 500 mg					287 [2] mg
Cadmium	0.2 – 30 mg	4.98 mg	3.9 mg			
Chromium	6.25 – 600 mg	111 mg	270 mg			
Cobalt	50 – 50 mg					50 [3] mg
Copper	8.4 – 840 mg	149 mg	190 mg			
Fluoride	10 – 96000 ug		140 ug			7000 ug (4) Bolton et 85
Iron	20000 – 290000 mg		280000 mg			
Lead	23 – 720 mg	128 mg	99 mg			
Manganese	300 – 1800 mg		1700 mg			
Mercury	0.1 – 15 mg	1.06 mg				0.8 [4] mg
Nickel	5 – 100 mg	48.6 mg	45 mg			
Selenium	5 – 5 mg					5 [5] mg
Zinc	50 – 3200 mg	459 mg	550 mg			
Acenaphthene	6.71 – 100000 ug			1300 ug		
Acenaphthylene	5.87 – 6000 ug				1900 ug	
Anthracene	6.8 – 41000 ug	845 ug	140 ug			

		Mar	Ind	EPA	Cub	
Ammonia	100 – 930 mg				340 mg	
Aroclor 1016	7 – 530 ug					100 [6] ug
Aroclor 1242	100 – 100 ug				100 ug	
Aroclor 1248	21 – 5100 ug					50 [6] ug
Aroclor 1254	7.3 – 604 ug					300 [6] ug
Aroclor 1260	5 – 240 ug					200 [6] ug
Benzo(a)anthracene		1050 ug				
Benzo(a)pyrene	9.6 – 450000 ug	1450 ug	470 ug			
Benzo(a)fluoranthene	550 – 3500 ug					750 [7] ug
Benzo(a)pyrene	9.6 – 450000		470 ug			
Benzo(b,k)fluoranthene	27 – 37 ug		37 ug			
Benzo(g,h,i)perylene	10.4 – 21000 ug		280 ug			
Benzo(k)fluoranthene	2.6 – 1250000 ug					750 [7] ug
Benzofluoranthenes	300 – 34000 ug				20000 ug	
Bis(2-ethylhexyl)phthalate	19.95 – 1197 ug				640 ug	
Butyl-n-phthalate	11000 – 500000 ug			11000 ug		
Butyl benzylphthalate	11000 – 500000 ug			11000 ug		
Carbazole	140 -1800 ug				1600 ug	
Chloroform	0.4 – 0.4 ug					0.4 [8] ug
Chrysene	8.6 – 11500 ug	1290 ug	500 ug			
Dibenzofuran	2000 – 32000 ug				2400 ug	
Dichlorobenzene	32 – 1200 ug			340 ug		
Di-nbutylphthalate	42 – 43 ug				42 ug	
Ethyl benzene	96 – 4800 ug			4800 ug		

		Mai	Ing	EPA	Cdbl	
Fluoranthene	20 – 130000 ug	2230 ug		6200 ug		
Fluorene		536 ug				
Indeno(1,2,3-cd)pyrene	10.4 – 6000000 ug		250 ug			
2-Methylnaphthalene	20 – 201 ug					201 [9] ug
Methylene chloride	500 – 500 ug					500 [4] ug
Naphthalene	10 – 140000 ug	561 ug	1400 ug			
Phenanthrene	6.8 – 210000 ug	1170 ug	350 ug			
Pyrene	7.6 – 85000 ug	1520 ug	350 ug			
Tetrachloroethane	2.2 – 1600 ug			1600 ug		
Total PAHs	200 – 700000 ug	22800 ug	2200 ug			
Total PCBs	2.0 – 40000 ug	676 ug	730 ug			
Aldrin	0.6 – 84 ug					5.3 [4] ug
Chlordane	0.3 – 60 ug	17.6 ug				5 [4] ug
Dieldrin	0.1 – 910 ug	61.8 ug		110 ug		
DDD	4 – 60 ug	28 ug				9 [10] ug
DDE	1 – 190 ug	31.3 ug				7 [6] ug
DDT	6 – 11000 ug	62.9 ug				8.28 [11] ug
Endrin	0.5 – 1300 ug			42 ug		
Total DDTs		572 ug				
Endrin		207 ug				
Heptachlor epoxide		16 ug				
Lindane		4.99 ug				

Aroclor 1254 7.3 - 604 ug 300 ug 6

1260 5 - 240 ug. 200 ug

Dibenz(ah) ? 83 ug. 230 ug ~~230~~ 6

Footnote: the hierarch of use of the alternative ESLs was as follows: MacDonald et al., 2000 as a preference: others (EPA, 1997, Ingersoll et al., 1996 etc) have no preference as compared to each other. The best available, most appropriate value is reported in these columns.

1	NYSDEC, 1994
2	TNRCC, 1996
3	OMOE, 1987
4	Bolton et al., 1985
5	Nagpal et al., 1995
6	MENVIQ/EC. 1992
7	NIPHEP, 1989
8	Stortelder et al., 1989
9	Environment Canada, 1999
10	Nagpal et al., 1998
11	USEPA, 1988

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Table 2. PCB ESLs for Sediment		
Type of ESL	**Range of Values mg/kg dry wt.**	**Definition**
≤ TEC	0.00 – 0.04	Values less than or equal to the threshold effect concentration (TEC).
> TEC but ≤ MEC	0.04 – 0.4	Values greater than the TEC but less than or equal to the moderate effect concentration (MEC).
> MEC but ≤ EEC	0.4 – 1.7	Values greater than the MEC but less than or equal to the extreme effect concentration (EEC).
> EEC	> 1.7	Values greater than the EEC.